



City of Santa Barbara
Parks and Recreation Department

Memorandum

DATE: November 18, 2009

TO: Creeks Restoration/Water Quality Improvement Program
Citizen Advisory Committee

FROM: Jill Murray, Water Resources Specialist

SUBJECT: WATER QUALITY MONITORING AND RESEARCH PROGRAM
FISCAL YEAR 2009 REPORT

COMMITTEE DIRECTION – FOR DISCUSSION

That the Committee receive a presentation and discuss the results from the Water Quality Monitoring and Research Program Fiscal Year 2009 Report.

DISCUSSION

Background

The Water Quality Monitoring Program provides data for the Creeks Division to establish baselines of water quality, track long term changes, and assess project performance. This information is needed to understand sources and routes of pollution to creeks, prioritize future projects for the Division, and to provide a basis for understanding the effectiveness of the current program. The Creeks Division strives to maintain a dynamic, adaptive monitoring program that is driven by specific research questions.

The goals of the monitoring program are to:

- Quantify the levels (concentration and flux, or load) of microbial contamination and chemical pollution in watersheds throughout the city.
- Evaluate the effectiveness of the City's restoration and water quality treatment projects in reducing contaminant and pollutant levels.
- Determine the water quality for aquatic organisms including fish, invertebrates, amphibians, and plants in watersheds throughout the City.
- Evaluate the effectiveness of the City's restoration and water quality treatment projects in improving water quality for aquatic organisms.

The underlying motivation behind the monitoring program is to obtain information that the City can use to:

- Develop strategies for water quality improvement, including prioritization of capital projects and outreach/education programs.
- Communicate effectively with the public about water quality.

The monitoring program consists of six key elements:

1. Routine watershed assessment
2. Storm monitoring
3. Restoration and Water Quality Project Assessment
4. Microbial Source Tracking
5. Creek Walks
6. Bioassessment

In June 2009, the Committee received a mid-year update on water quality monitoring and concurred with the recommendation to implement the proposed Fiscal Year 2010 Research Plan. Topics discussed in June 2009 included wildfire impacts to water quality, results from toxicity testing, and an assessment of sediment quality. In November 2008, the Committee discussed changes to Research Plan for Fiscal Year 2009. At the present time, the Committee will receive summary of the Fiscal Year 2009 Annual Water Quality Report. Please see the attached map to identify sampling locations. The final report is still in draft form and will be available online in January 2010.

Routine Watershed Assessment

Routine watershed assessment focuses on microbial pollution (as defined by indicator bacteria) and water quality for aquatic organisms (physicochemical properties such as pH, temperature, dissolved oxygen, turbidity, conductivity). During Fiscal Year 2009, Routine Watershed Assessment also focused on quantifying loads of chemical pollutants in creeks during dry weather, assessing toxicity of creek water in dry weather, and assessing pollutants in sediment.

Research questions:

- Is overall water quality getting better over time?
- Are new hot spots emerging?
- Which subwatersheds contribute the greatest loads of pollutants to creeks in Santa Barbara?
- Do creeks in Santa Barbara have problems with toxicity, particularly in relation to dissolved copper, in dry weather?
- How contaminated and/or toxic is sediment at creek outfall sites?
- How does creek water quality relate to beach warnings at Santa Barbara beaches?

Highlights:

- Based on Federal and State regulations, the County uses fecal indicator bacteria levels to determine beach warnings at Santa Barbara beaches. An analysis of annual beach grades (from Heal the Bay), based on the County's results, suggests that water quality has improved at Santa Barbara beaches since grading began in 1999, particularly for wet weather. Additional data collection and analysis will be conducted to investigate whether the improvement is due primarily to the impacts of weather and rainfall. There are many limitations with using indicator bacteria to assess water quality, including the lack of consistent correlation with the presence of human pathogens and the ability of indicator bacteria to grow in the environment. Because of the limitations, the US EPA is currently seeking a better indicator of beach water quality.
- Despite enormous variability in fecal indicator bacteria levels in creek samples, *Enterococcus* levels appear to have decreased in lower Mission Creek in the past five years.
- A combined analysis of quarterly load results showed that the majority of contaminants entering creeks during dry weather occur in the lower reaches. Using flow measurements and contaminant concentrations, the combined analysis showed that the bulk of pollutants in Arroyo Burro during dry weather enter the creek between the confluence with San Roque Creek and the confluence with Las Positas Creek. In Mission Creek, during low-flow conditions, approximately half of the pollutants arrive from Old Mission Creek and half arrive between the confluence of Old Mission Creek and Mission Creek at Montecito Street.
- Vertebrate toxicity testing, which includes exposing fathead minnows to creek water for five days, showed that the Santa Barbara creeks do not have a problem with toxicity in dry weather. Of twenty four samples collected from Mission Creek, Arroyo Burro, Laguna Channel, and Sycamore Creek during dry weather, only one showed less than 95% survival, with a value of 90%.
- Using the latest US EPA-approved method for assessing copper toxicity, which involves calculating site-specific criteria based on several water quality parameters, sampling showed that none of the sites tested exceeded dissolved copper criteria in dry weather. In addition, dissolved copper values were lower than those reported to cause temporary neurological impairment in steelhead.
- After two years of sediment testing in the lagoons at each integrator site, sediment showed no toxicity using the test organism *Euhaustoriaus* (92 - 100% survival at each site). Using California's new Final Sediment Quality Objectives for Enclosed Bays and Estuaries to integrate chemical and toxicity data, Arroyo Burro Estuary, Mission Lagoon, Sycamore Lagoon, and the Andre Clark Bird Refuge were determined to have "minimal potential" for a chemically mediated effect on the benthic community. Laguna Channel sediments were scored as having a "low potential" for chemically mediated effects on the benthic community, primarily due to chlordane, and also cadmium, lead, and zinc. The

pyrethroid bifenthrin was found at the Bird Refuge was somewhat close to a sediment quality guideline.

Storm Monitoring

Trace metals, pesticides/herbicides, and additional organic pollutants can have deleterious effects on aquatic organisms and human health. The purpose of storm monitoring is to identify chemical constituents of concern and to identify pollution hot spots. The monitoring program over the past several years has strived to sample the “first flush”, thereby testing the worst-case scenario in order to identify pollutants of concern.

Research Questions:

- What are the highest concentrations of pollutants of concern during storm events, particularly seasonal first flush storms?
- What are the loads of pollutants discharged from Santa Barbara creeks during storms?
- How do concentrations and loads vary during storms?
- What are the sources and routes of pollutants during storms?
- Do creeks in Santa Barbara have problems with toxicity, particularly in relation to dissolved copper, during storm events?
- How do restoration/treatment projects impact water quality during storm events?

Highlights:

- Six storms were sampled in Fiscal Year 2009.
- Seasonal first flush sampling, which captures early runoff from the first storm of the season and generally produces the highest levels of pollutants seen in the creeks, was conducted in October and November 2008. These results were the second set to include toxicity measurements during storm runoff. Similar to last year, survival of fathead minnows in the toxicity test was 100% for Mission Creek and 95% for Arroyo Burro. However, only 25% survival was found in the sample from the Laguna Channel, which was collected very early during the first rainfall. No pesticides or herbicides were detected in creek samples. The only chemical constituent found to exceed current water quality criteria was MBAS, a class of surfactants most often found in detergents.
- Wildfire impacts to water quality were tested after the Tea Fire. Results showed that there were higher levels of suspended sediment and several metals in the burned site (Sycamore watershed) versus the unburned site (Mission Canyon). The levels of metals were well below standards known to cause toxicity in aquatic organisms. All PAHs and the metals lead, cadmium, chromium, selenium, and silver were not detected at either site. Samples from a downstream Sycamore Creek site, collected after more rain had fallen, did not show high levels of any metals or PAHs compared to storm sampling in previous years.

- Baseline samples were collected for the West Figueroa area (two storms), the Upper Las Positas Creek Project, and the Low Impact Development Demonstration Project.

Restoration and Water Quality Project Assessment

The Creeks Division has completed several restoration and water quality improvement capital projects. Project assessment is used to determine the success of these projects in lowering microbial and chemical pollution levels and improving water quality for aquatic organisms. In some cases project monitoring is grant-required, and the remaining project monitoring is for internal review of project effectiveness.

Research Questions:

- Do Creeks Division projects result in improved water quality, as reflected in pre- and post-project, and/or, upstream to downstream, conditions?
- What is the baseline water quality at future restoration/treatment sites?
- What are the mechanisms of project success?

Highlights

- The second season of operation of the Westside SURF project was evaluated. The project has been highly successful in eliminating indicator bacteria in runoff from the Westside Drain. Indicator bacteria results return to background levels relatively quickly downstream. Ongoing research is looking into the mechanism behind the increase in levels.
- Additional baseline values were collected for proposed water quality projects at the Santa Barbara Golf Course (storm sample) and West Figueroa on Mission Creek (dry weather). In addition, the Andre Clark Bird Refuge was monitored, but data is still being analyzed. Ongoing post-project data was collected for Mesa Creek daylighting.

Creek Walks

Creek walks from the ocean to upper watersheds are used to identify problem areas and track changes due to natural processes and human activity. Problem areas may include sources of polluted input to the creeks, sites of habitat degradation, or failing bank structures. Problem areas that are typically not seen from roads can be identified, cleaned up, and monitored.

Research Questions:

- How have the number and location of water pollution sources changed over time?
- Are there new problems in creeks that need to be addressed?
- Were decreases in trash observed between 1999 and 2005 due to creek flow histories or the impact of City programs?

- Will the installation of catch basin screens lead to decreased trash observed in creeks?

Highlights

- The second year of baseline data was collected for assessing the impact of catch basin screens in the Westside Neighborhood on trash in Old Mission Creek

Microbial Source Tracking

Microbial source tracking is used to develop better tools for tracking fecal pollution in creeks and to identify sources of indicator bacteria. The Creeks Division has gathered extensive data on the presence of indicator bacteria throughout its watersheds, however, the specific sources of pollution and the degree to which the recreational waters are harmful to human health are not known.

Research Questions

- Which locations in creeks and drains have consistent presence of human waste?
- Where does such waste enter drainage systems?
- What happens to the signals of human waste and indicator bacteria levels as water moves downstream away from the source?
- How does presence of human waste relate to beach warnings?

Highlights

- The Laguna Watershed Study, which involved dry weather hydrology and microbial source tracking, was completed in Fiscal Year 2009.
- Results from the Laguna Watershed Study were used to form a recommendation for installing ultraviolet disinfection at the discharge of Laguna Channel.
- Ongoing source tracking in the Laguna Channel storm drain network has identified locations with relatively high concentrations of fecal contamination. These sites are under ongoing investigation to determine locations of inputs.
- Sampling for the Source Tracking Protocol Development Project began in August 2009. Additional sampling will take place through October 2010.
- A preproposal to the Water Environment Research Federation, for to test canine scent tracking as a source tracking tool, was selected for full proposal submission in October 2009.

Bioassessment

The biological assessment element is used to assess and monitor the biological integrity of local creeks as they respond through time to natural and human influences.

Research Questions:

- What is the baseline of biological integrity for benthic macroinvertebrates in creeks?
- Are there differences between upper watershed and lower watershed sites?
- Are there differences among watersheds?

- How does the biological integrity in our creeks change over time?
- How does the biological integrity respond to habitat restoration projects?

Highlights

- As reported by the consultant to the Creeks Division, Ecology Consultants, the Index of Biological Integrity (IBI) scores at most of the study reaches were similar in 2008 to those in 2007, which together were lower than those found in 2005 and 2006. For lower reaches of creeks, especially, a lack of heavy rainfall and scouring discharges are thought to be the cause of this trend.
- Sufficient data has been collected to test hypotheses and patterns statistically. In the 2009 bioassessment effort, the data amassed thus far will be used to calculate a new Index of Biological Integrity and examine causes of impairments.

Next Steps

Staff will continue implementing the FY 10 Research Plan and carry out scheduled weekly, quarterly, project, and storm sampling. Staff will also conduct research with UCSB on the Source Tracking Protocol grant.

cc: Cameron Benson, Creeks Manager
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